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25 March 1996

AGREEMENT

CONCERNING THE ADOPTION OF UNIFORM TECHNICAL PRESCRIPTIONS FOR WHEELED VEHICLES, EQUIPMENT AND PARTS WHICH CAN BE FITTED AND/OR BE USED ON WHEELED VEHICLES AND THE CONDITIONS FOR RECIPROCAL RECOGNITION OF APPROVALS GRANTED ON THE BASIS OF THESE PRESCRIPTIONS */

(Revision 2, including the amendments entered into force on 16 October 1995)

Addendum 98: Regulation No. 99

Date of entry into force: 15 April 1996

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF GAS-DISCHARGE LIGHT SOURCES FOR USE IN APPROVED GAS-DISCHARGE LAMP UNITS OF POWER-DRIVEN VEHICLES

UNITED NATIONS

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*/ Former title of the Agreement:

Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

GE.96-21466

Regulation No. 99

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF GAS-DISCHARGE LIGHT SOURCES FOR USE IN APPROVED GAS-DISCHARGE LAMP UNITS OF POWER-DRIVEN VEHICLES

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1. SCOPE

This Regulation applies to gas-discharge light sources shown in annex 1 and intended for use in approved gas-discharge lamp units of power-driven vehicles.

2. ADMINISTRATIVE PROVISIONS

2.1. Definitions

2.1.1. The term "category" is used in this Regulation to describe different basic designs of standardized gas-discharge light sources. Each category has a specific designation, as for example: "D2S".

2.1.2. Gas-discharge light sources of different "types" are gas-discharge light sources within the same category which differ in such essential respects as:

2.1.2.1. Trade name or mark; 1/

2.1.2.2. Bulb design, in so far as these differences affect the optical results;

2.1.2.3. Bulb colour. A yellow bulb or an additional yellow outer bulb, solely intended to change the colour but not the other characteristics of a gas-discharge light source emitting white light, does not constitute a change of type of the gas-discharge light source.

2.2. Application for approval

2.2.1. Application for approval shall be submitted by the owner of the trade name or mark, or by his duly accredited representative.

2.2.2. Every application for approval shall be accompanied (see also paragraph 2.4.2.) by:

2.2.2.1. Drawings in triplicate, sufficiently detailed to permit identification of the type;

2.2.2.2. A technical description including ballast identification;

2.2.2.3. Three samples of each colour which has been applied for;

1/ Gas-discharge light sources bearing the same trade name or mark but produced by different manufacturers are considered as being of different types. Gas-discharge light sources produced by the same manufacturer differing only by the trade name or mark may be considered to be of the same type.

2.2.2.4. One sample of the ballast.

2.2.3. In the case of a type of gas-discharge light source differing only by the trade name or mark from a type that has already been approved, it shall be sufficient to submit:

2.2.3.1. A declaration by the manufacturer that the type submitted is (except in the trade name or mark) identical to and has been produced by the same manufacturer as the type already approved, the latter being identified by its approval code;

2.2.3.2. Two samples bearing the new trade name and mark.

2.2.4. The competent authority shall verify the existence of satisfactory arrangements for ensuring effective control of the conformity of production before type approval is granted.

2.3. Inscriptions

2.3.1. Gas-discharge light sources submitted for approval shall bear on the cap:

2.3.1.1. The trade name or mark of the applicant;

2.3.1.2. The international designation of the relevant category;

2.3.1.3. The rated wattage; this need not be indicated separately if it is part of the international designation of the relevant category;

2.3.1.4. A space of sufficient size to accommodate the approval mark.

2.3.2. The space mentioned in paragraph 2.3.1.4. shall be indicated in the drawings accompanying the application for approval.

2.3.3. Other inscriptions than those covered by paragraphs 2.3.1. and 2.4.4. may be affixed on the cap.

2.3.4. The ballast used for the type approval of the light source shall be marked with type and trade mark identification and with the rated voltage and wattage, as indicated on the relevant lamp data sheet.

2.4. Approval

2.4.1. If all samples of a type of gas-discharge light source which are submitted in accordance with paragraphs 2.2.2.3. or 2.2.3.2. comply with the requirements of this Regulation when tested with the ballast according to paragraph 2.2.2.4., approval shall be granted.

2.4.2. An approval code shall be assigned to each type approved. Its first character shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval.

This will be followed by an identification code comprising not more than two characters. Only the Arabic numerals and capital letters listed in footnote 2/ shall be used.
The same Contracting Party may not assign the same code to another type of gas-discharge light source. If the applicant so desires the same approval code may be assigned to both the gas-discharge light sources emitting white and yellow light (see paragraph 2.1.2.3.).

2.4.3. Notice of approval or of extension, or refusal or withdrawal of approval or production definitely discontinued of a type of gas-discharge light source pursuant to this Regulation shall be communicated to the Parties of the Agreement which apply this Regulation by means of a form conforming to the model in annex 2 to this Regulation and of a drawing, supplied by the applicant, for approval, in a format not exceeding A4 (210 x 297 mm) and on a scale of at least 2 : 1.

2.4.4. To every gas-discharge light source conforming to a type approved under this Regulation there shall be affixed in the space referred to in paragraph 2.3.1.4., in addition to the inscription required under paragraph 2.3.1., an international approval mark consisting of:

2.4.4.1. A truncated circle surrounding the letter "E" followed by the distinguishing number of the country granting approval; 3/

2.4.4.2. The approval code, placed close to the truncated circle.

2/ 0 1 2 3 4 5 6 7 8 9
A B C D E F G H J K L M N P R S T U V W X Y Z

3/ 1 for Germany, 2 for France, 3 for Italy, 4 for the Netherlands, 5 for Sweden, 6 for Belgium, 7 for Hungary, 8 for the Czech Republic, 9 for Spain, 10 for Yugoslavia, 11 for the United Kingdom, 12 for Austria, 13 for Luxembourg, 14 for Switzerland, 15 (vacant), 16 for Norway, 17 for Finland, 18 for Denmark, 19 for Romania, 20 for Poland, 21 for Portugal, 22 for the Russian Federation, 23 for Greece, 24 (vacant), 25 for Croatia, 26 for Slovenia, 27 for Slovakia, 28 for Belarus, 29 for Estonia, 30-36 (vacant) and 37 for Turkey. Subsequent numbers shall be assigned to other countries in the chronological order in which they ratify or accede to the Agreement concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, and the numbers thus assigned shall be communicated by the Secretary-General of the United Nations to the Contracting Parties to the Agreement.

2.4.5. If the applicant has obtained the same approval code for several trade names or marks, one or more of them will suffice to meet the requirements of paragraph 2.3.1.1.

2.4.6. The marks and inscriptions specified in paragraphs 2.3.1. and 2.4.3. shall be clearly legible and indelible.

2.4.7. Annex 3 to this Regulation gives an example of a type of approval mark.

3. TECHNICAL REQUIREMENTS

3.1. Definitions

3.1.1. "Gas-discharge light source": Light source in which the light is produced by a stabilized discharge arc.

3.1.2. "Ballast": Specific electrical supply for the gas-discharge light source.

3.1.3. "Rated voltage": Input voltage marked on the ballast.

3.1.4. "Rated wattage": Wattage marked on the gas-discharge light source and ballast.

3.1.5. "Test voltage": Voltage at the input terminals of the ballast for which the electrical and photometric characteristics of the gas-discharge light source are intended and are to be tested.

3.1.6. "Objective value": Design value of an electrical or photometric characteristic. To be achieved, within the specified tolerances, when the gas-discharge light source is energized by the ballast operated at the test voltage.

3.1.7. "Standard (etalon) gas-discharge light source": Special gas-discharge light source used for the testing of headlamps. It has reduced dimensional, electrical and photometric characteristics as specified on the relevant data sheet.

3.1.8. "Reference axis": An axis defined with reference to the cap and to which certain dimensions of the gas-discharge light source are referred.

3.1.9. "Reference plane": A plane defined with reference to the cap and to which certain dimensions of the gas-discharge light source are referred.

3.2. General specifications

3.2.1. Each sample submitted shall conform to the relevant specifications of this Regulation when tested with the ballast according to paragraph 2.2.2.4.

3.2.2. Gas-discharge light sources shall be so designed as to be and to remain in good working order when in normal use. They shall moreover exhibit no fault in design or manufacture.

3.3. Manufacture

3.3.1. The bulb of the gas-discharge light source shall exhibit no marks or spots which might impair their efficiency and their optical performance.

3.3.2. In the case of a coloured (outer) bulb, after an operating period of 15 hours with the ballast at test voltage, the surface of the bulb shall be lightly wiped with a cotton cloth soaked in a mixture of 70 volume per cent of n-heptane and 30 volume per cent of toluol. After five minutes, the surface shall be inspected visually. It shall not show any apparent changes.

3.3.3. Gas-discharge light sources shall be equipped with standard caps, complying with the cap data sheets of IEC Publication 61, third edition, as specified on the individual data sheets of annex 1.

3.3.4. The cap shall be strong and firmly secured to the bulb.

3.3.5. To ascertain whether gas-discharge light sources conform to the requirements of paragraphs 3.3.3. to 3.3.4., a visual inspection, a dimension check and, where appropriate, a trial fitting shall be carried out.

3.4. Tests

3.4.1. Gas-discharge light sources shall be aged as indicated in annex 4.

3.4.2. All samples shall be tested with the ballast, according to paragraph 2.2.2.4.

3.4.3. Electrical measurements shall be carried out with instruments of at least class 0.2. (0.2 per cent full scale accuracy).

3.5. Position and dimensions of electrodes, arc and stripes

3.5.1. The geometric position of the electrodes shall be as specified on the relevant data sheet. An example of a method of measuring arc and electrodes position is given in annex 5. Other methods may be used.

3.5.1.1. The position and dimensions of the light source electrodes shall be measured before the ageing period, the gas-discharge light source unlit and using optical methods through the glass envelope.

3.5.2. The shape and the displacement of the arc shall conform to the requirements as given on the relevant data sheet.

3.5.2.1. The measurement shall be made after ageing with the light source supplied by the ballast at test voltage.

3.5.3. The position and dimension and transmission of the stripes shall comply with the requirements as given on the relevant data sheet.

3.5.3.1. The measurement shall be made after ageing with the light source supplied by the ballast at test voltage.

3.6. Starting, run-up and hot-restrike characteristics

3.6.1. Starting

When tested according to the conditions specified in annex 4, the gas-discharge light source shall start directly and remain alight.

3.6.2. Run-up

When measured according to the conditions specified in annex 4, the gas-discharge light source shall emit at least:

After 1 second : 25 per cent of its objective luminous flux;

After 4 seconds: 80 per cent of its objective luminous flux.

The objective luminous flux as indicated on the relevant data sheet.

3.6.3. Hot-restrike

When tested according to the conditions specified in annex 4, the gas-discharge light source shall restart directly after being switched-off for a period, as indicated on the data sheet. After one second the light source shall emit at least 80 per cent of its objective luminous flux.

3.7. Electrical characteristics

When measured according to the conditions specified in annex 4, the voltage and wattage of the light source shall be within the limits given on the relevant data sheet.

3.8. Luminous flux

When measured according to the conditions specified in annex 4, the luminous flux shall be within the limits given on the relevant data sheet. In the case where white and yellow is specified for the same type, the objective value applied to light sources emitting white light, whereas the luminous flux of the light source emitting yellow light shall be at least 68 per cent of the specified value.

3.9. Colour

3.9.1. The colour of the light emitted shall be white or yellow, as prescribed on the relevant data sheet.

3.9.2. In case of white light, the colorimetric characteristics, expressed in CIE chromaticity coordinates, shall lie within the limits given

on the relevant data sheet which are to be within the area formed by the following limits:

Towards blue	$x \geq 0.310$
Towards yellow	$x \leq 0.500$
Towards green	$y \leq 0.150 + 0.640\ x$
Towards green	$y \leq 0.440$
Towards purple	$y \geq 0.050 + 0.750\ x$
Towards red	$y \geq 0.382$

3.9.3. In case of yellow light, the colorimetric characteristics shall lie within the area formed by the following limits:

Towards red	$y \geq 0.138 + 0.580\ x$
Towards green	$y \leq 1.29\ x - 0.100$
Towards white	$y \geq -x + 0.940$ and $y \geq 0.440$
Towards spectral value	$y \leq -x + 0.992$

3.9.4. The colour shall be measured according to the conditions specified in annex 4, paragraph 10.

3.9.5. The minimum red content of the light of a gas-discharge light source emitting white light shall be such that:

$$k_{red} = \frac{\int_{\lambda=610nm}^{780nm} E_e(\lambda) \cdot v(\lambda) \cdot d\lambda}{\int_{\lambda=380nm}^{780nm} E_e(\lambda) \cdot v(\lambda) \cdot d\lambda} \geq 0.05$$

where:

$E_e(\lambda)$	[W]	is the spectral distribution of the irradiance;
$v(\lambda)$	[1]	is the spectral luminous efficiency;
(λ)	[nm]	is the wave length.

This value shall be calculated using intervals of one nanometre.

3.10. UV-radiation

The UV-radiation of the gas-dischage light source shall be such that:

$$k_{UV} = \frac{\int_{\lambda=250nm}^{400nm} E_e(\lambda) \cdot S(\lambda) \cdot d\lambda}{k_m \int_{\lambda=380nm}^{780nm} E_e(\lambda) \cdot v(\lambda) \cdot d\lambda} \leq 10^{-5} \quad W/lm$$

where:

$S(\lambda)$ [1] is the spectral weighting function;
$k_m = 683$ [lm/W] is the photometric radiation equivalent;
(For definitions of the other symbols see paragraph 3.9.5. above).

This value shall be calculated using intervals of one nanometre. The UV - radiation shall be weighted according to the values as indicated in the following table:

λ	S(λ)	λ	S(λ)	λ	S(λ)
250	0.430	305	0.060	355	0.00016
255	0.520	310	0.015	360	0.00013
260	0.650	315	0.003	365	0.00011
265	0.810	320	0.001	370	0.00009
270	1.000	325	0.00050	375	0.000077
275	0.960	330	0.00041	380	0.000064
280	0.880	335	0.00034	385	0.000053
285	0.770	340	0.00028	390	0.000044
290	0.640	345	0.00024	395	0.000036
295	0.540	350	0.00020	400	0.000030
300	0.300				

Wavelengths chosen are representative; other values should be interpolated.

Values according to "IRPA/INIRC Guidelines on limits of exposure to ultraviolet radiation".

3.11. Standard gas-discharge light sources

Standard (etalon) gas-discharge light sources shall comply with the requirements applicable to type approval light sources and to the specific requirements as stated in the relevant data sheet. In the case of a type emitting white and yellow light the standard light source shall emit white light.

4. CONFORMITY OF PRODUCTION

4.1. Gas-discharge light sources approved to this Regulation shall be so manufactured as to conform to the type approved by meeting the inscriptions and technical requirements set forth in paragraph 3 above and annexes 1 and 3 to this Regulation.

4.2. In order to verify that the requirements of paragraph 4.1. are met, suitable controls of the production shall be carried out.

4.3. The holder of the approval shall in particular:

4.3.1. ensure existence of procedures for the effective control of the quality of products,

4.3.2. have access to the control equipment necessary for checking the conformity to each approved type,

4.3.3. ensure that data of test results are recorded and that related documents shall remain available for a period to be determined in accordance with the administrative service,

4.3.4. analyse the results of each type of test, applying criteria of annex 7, in order to verify and ensure the stability of the product characteristics making allowance for variation of an industrial production,

4.3.5. ensure that for each type of gas-discharge light source, at least the tests prescribed in annex 6 to this Regulation are carried out,

4.3.6. ensure that any collecting of samples giving evidence of non-conformity with the type of test considered shall give rise to another sampling and another test. All the necessary steps shall be taken to re-establish the conformity of the corresponding production.

4.4. The competent authority which has granted type-approval may at any time verify the conformity control methods applicable to each production unit.

4.4.1. In every inspection, the test books and production survey records shall be presented to the visiting inspector.

4.4.2. The inspector may take samples at random which will be tested in the manufacturer's laboratory. The minimum number of samples may be determined according to the results of the manufacturer's own verification.

4.4.3. When the quality level appears unsatisfactory or when it seems necessary to verify the validity of the tests carried out in application of paragraph 4.4.2. above, the inspector shall select samples, to be sent to the technical service which has conducted the type approval tests.

4.4.4. The competent authority may carry out any tests prescribed in this Regulation. These tests will be on samples selected at random without causing distortion of the manufacturer's delivery commitments and in accordance with the criteria of annex 8.

4.4.5. The competent authority shall strive to obtain a frequency of inspection of once every two years. However, this is at the discretion of the competent authority and their confidence in the arrangements for ensuring effective control of the conformity of production. In the case where negative results are recorded, the competent authority shall ensure that all necessary steps are taken to re-establish the conformity of production as rapidly as possible.

5. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

5.1. The approval granted in respect of a gas-discharge light source pursuant to this Regulation may be withdrawn if the prescribed conformity of production requirements are not met.

5.2. If a Contracting Party to the Agreement applying this Regulation withdraws an approval previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of the communication form conforming to the model in annex 2 to this Regulation.

6. PRODUCTION DEFINITELY DISCONTINUED

If the holder of the approval completely ceases to manufacture a gas-discharge light source type approved in accordance with this Regulation, he shall so inform the authority which had granted the approval. Upon receiving the relevant communication, that authority shall inform thereof the other Parties to the Agreement applying this Regulation by means of the communication form conforming to the model in annex 2 to this Regulation.

7. NAMES AND ADDRESSES OF THE TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS, AND OF ADMINISTRATIVE DEPARTMENTS

The Parties to the Agreement which apply this Regulation shall communicate to the Secretariat of the United Nations the names and addresses of the technical services responsible for conducting approval tests and of the administrative departments which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval, or production definitely discontinued, issued in other countries, are to be sent.

Annex 1

Categories D1S and D2S — Sheet D1S/D2S/1

The drawings are intended only to indicate the essential dimensions of the gas-discharge light source

Figure 1 — **Category D1S** — **Type with cables** — **Cap PK 32d-2**

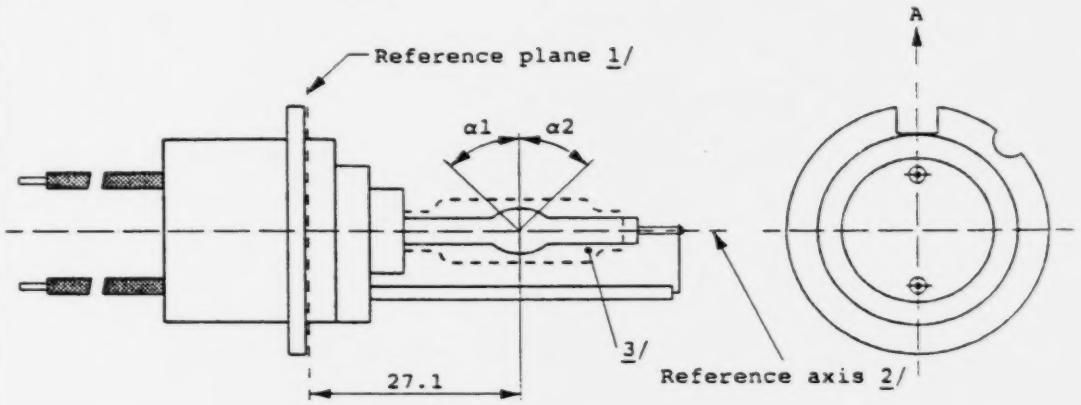
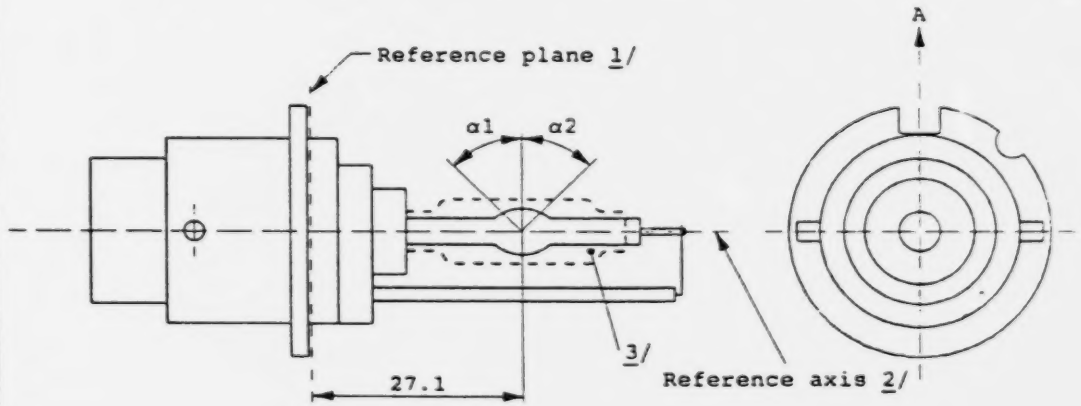


Figure 2 — **Category D2S** — **Type with connector** — **Cap P 32d-2**



1/ The reference plane is defined by the positions on the surface of the holder on which the three supporting bosses of the cap ring will rest.

2/ See sheet D1S/D2S/2.

3/ When measured at a distance of 27.1 mm from the reference plane and with respect to the mid-point of the inner bulb, the outer bulb shall have an eccentricity of 1 mm max.

Figure 3
Definition of reference axis 1/

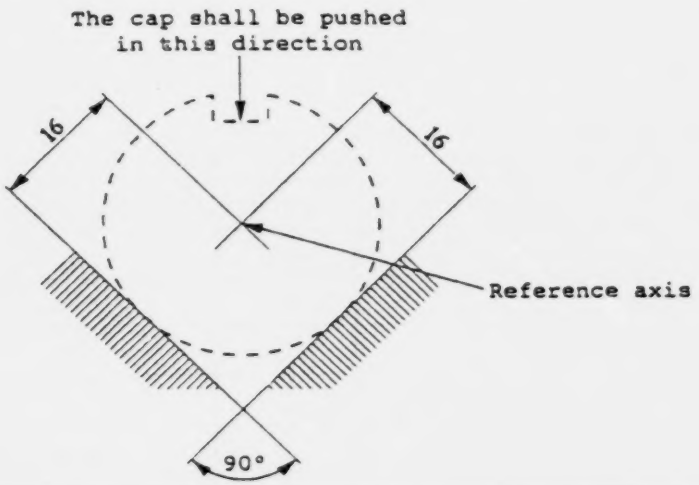
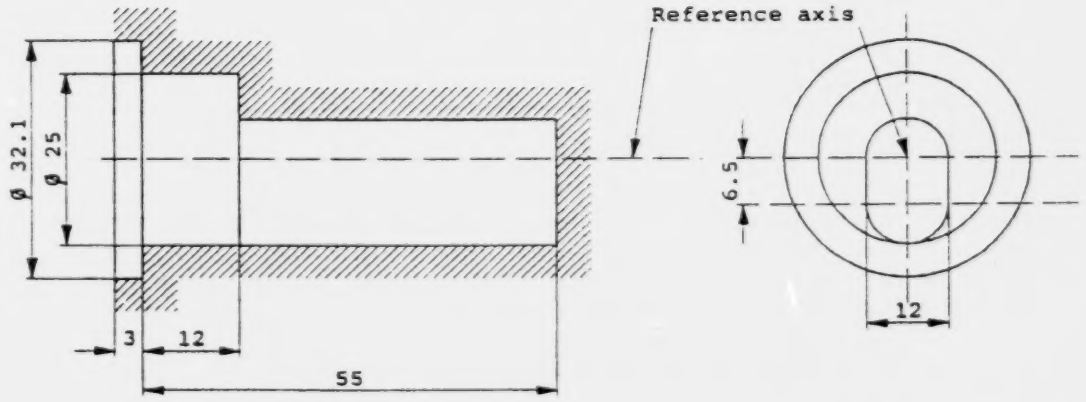


Figure 4
Maximum lamp outline 2/



1/ The reference axis is perpendicular to the reference plane and crosses the intersection of the two parallel lines as indicated in figure 3.

2/ Glass bulb and supports shall not exceed the envelope, as indicated in figure 4. The envelope is concentric with the reference axis.

Categories D1S and D2S — Sheet D1S/D2S/3

Dimensions			Production light sources	Standard light sources
Position of the electrodes			Sheet D1S/D2S/4	
Position and form of the arc			Sheet D1S/D2S/5	
α1, α2 1/			55° min.	55° min.
Category D1S: cap PK 32d-2 in accordance with IEC 61-1 (sheet 7004-111-1) Category D2S: cap P 32d-2 in accordance with IEC 61-1 (sheet 7004-111-1)				
ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS				
Rated voltage of the ballast		V	12 2/	12
Rated wattage		W	35	35
Test voltage		V	13.5	13.5
Lamp voltage	Objective	V	85	85
	Tolerance		± 17	± 8
Lamp wattage	Objective	W	35	35
	Tolerance		± 3	± 0.5
Luminous flux	Objective	lm	3 200	3 200
	Tolerance		± 450	± 150
Coulour coordinates	Objective		x = 0.375	y = 0.375
	Tolerance area 3/		x ≥ 0.345 y ≤ 0.150 + 0.640 x x ≤ 0.405 y ≥ 0.050 + 0.750 x	
Hot-restrike switch-off time		s	10	10

1/ The part of the bulb within the angles α1 and α2 shall be the light-emitting part. This part shall be as homogenous in form as possible and shall be optically distortion free. This applies to the whole bulb circumference within the angles α1 and α2.

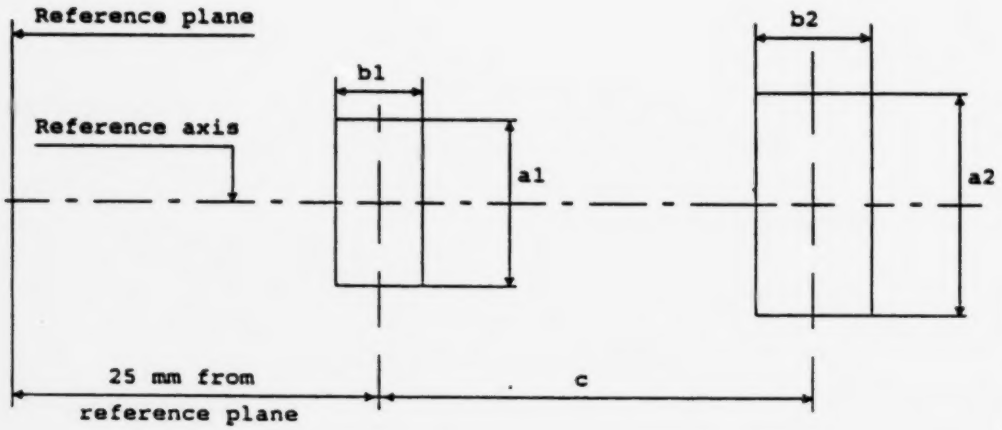
2/ Application voltages of ballasts may differ from 12 V.

3/ See annex 4.

Categories D1S and D2S **Sheet D1S/D2S/4**

Position of the electrodes

This test is used to determine whether the electrodes are correctly positioned relative to the reference axis and the reference plane.



Measuring direction: light source side and top view

Dimension in mm	Production light sources	Standard light sources
a1	d + 0.2	d + 0.1
a2	d + 0.5	d + 0.25
b1	0.3	0.15
b2	0.6	0.3
c	4.2	4.2

d=diameter of the electrode < 0.3

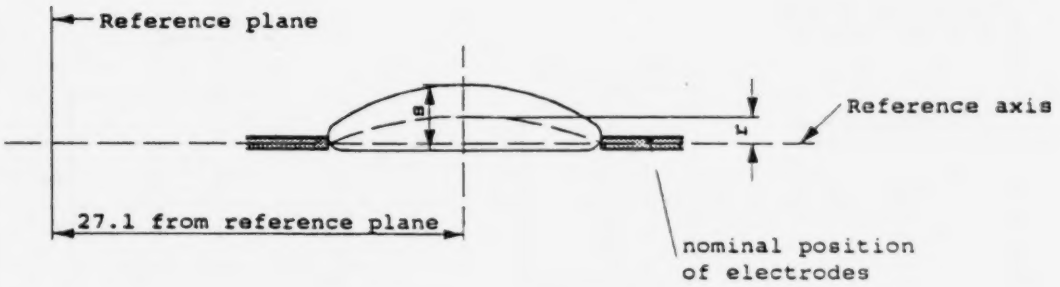
The top of the electrode nearest to the reference plane shall be positioned in the area defined by a1 and b1. The top of the electrode furthest from the reference plane shall be positioned in the area defined by a2 and b2.

Categories D1S and D2S — Sheet D1S/D2S/5

Position and form of the arc

This test is used to determine the form of the arc and its position relative to the reference axis and plane by measuring its bending and diffusion in the cross section at a distance 27.1 mm from the reference plane.

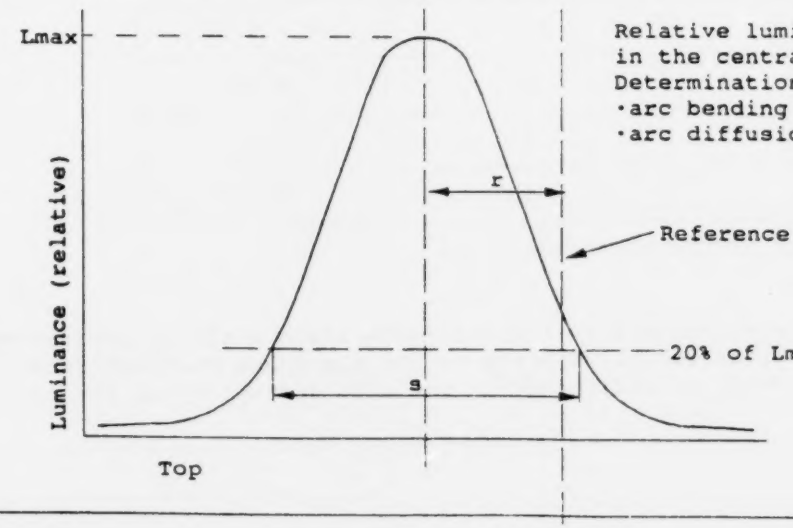
The form of the arc is for illustration purposes only.



Measuring direction: light source side view

When measuring the relative luminance distribution in the central cross section as indicated in the drawing above, the maximum value shall be located within a distance r from the reference axis. The points of 20% of the maximum value shall be within s.

Dimension in mm	Production light sources	Standard light sources
r	0.50 ± 0.40	0.50 ± 0.20
s	1.10 ± 0.40	1.10 ± 0.25

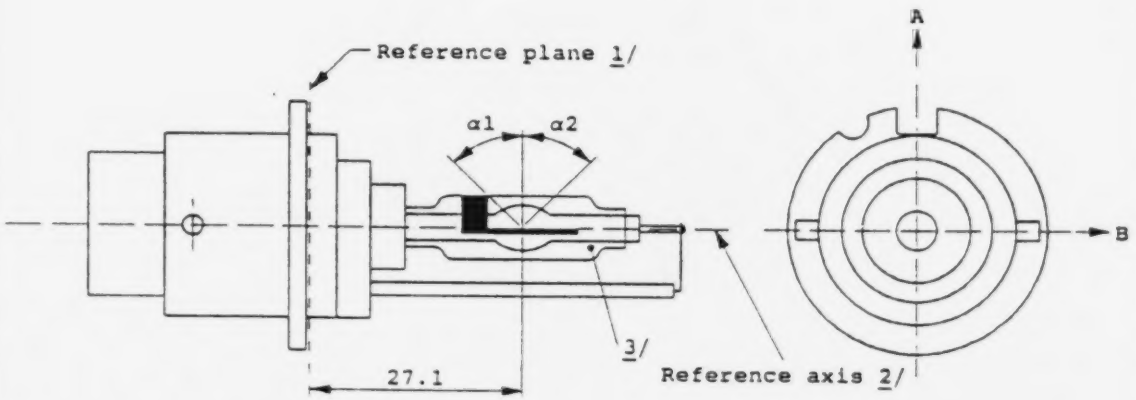


Relative luminance distribution in the central cross section.
Determination of:
·arc bending r
·arc diffusion s

Category D2R Sheet D2R/1

The drawings are intended only to indicate the essential dimensions of the gas-discharge light source

Figure 1 Category D2R Cap P 32d-3



1/ The reference plane is defined by the positions on the surface of the holder on which the three supporting bosses of the cap ring will rest.

2/ See sheet D2R/2.

3/ With respect to the reference axis, when measured at a distance of 27.1 mm from the reference plane the eccentricity of the outer bulb shall be less than ± 0.5 mm in direction B and less than + 1 mm - 0.5 mm in direction A.

Category D2R Sheet D2R/2

Figure 2
Definition of reference axis 1/

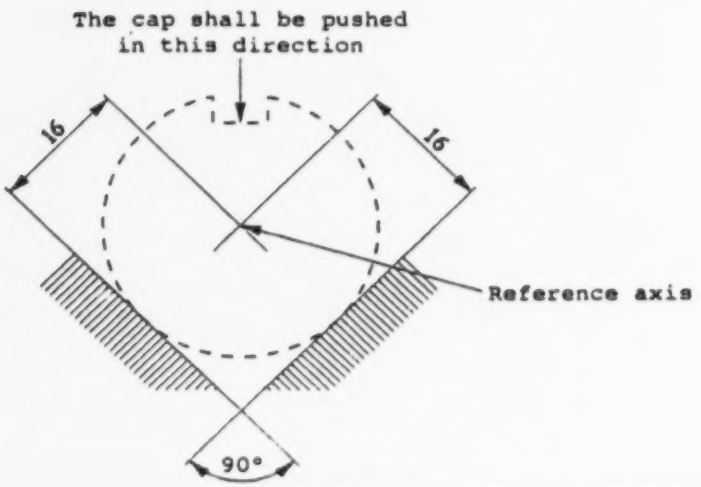
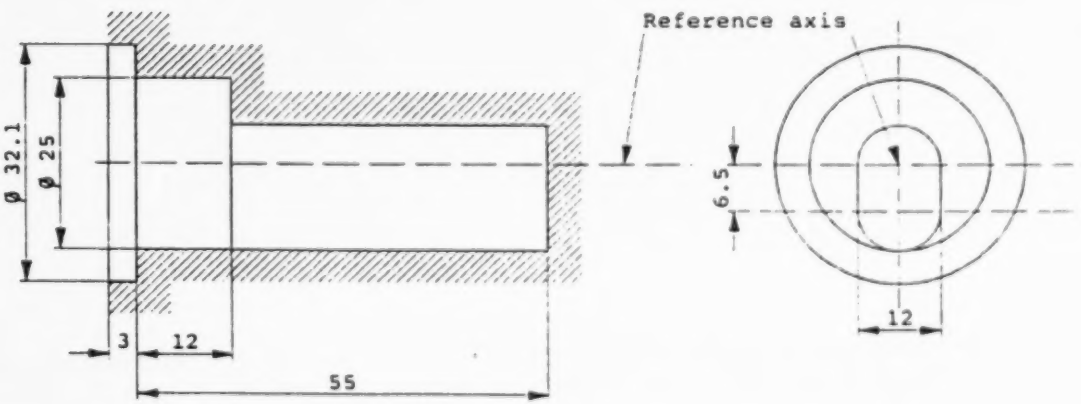


Figure 3
Maximum lamp outline 2/



1/ The reference axis is perpendicular to the reference plane and crosses the intersection of the two parallel lines as indicated in figure 2.

2/ Glass bulb and supports shall not exceed the envelope, as indicated in figure 3. The envelope is concentric with the reference axis.

Category D2R — Sheet D2R/3

Dimensions			Production light sources	Standard light sources
Position of the electrodes			Sheet D2R/4	
Position and form of the arc			Sheet D2R/5	
Position of the black stripes			Sheet D2R/6	
$\alpha 1$, 1/			45° ± 5°	
$\alpha 2$, 1/			45° min.	
Cap P 32d-3 in accordance with IEC 61-1 (sheet 7004-111-1)				
ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS				
Rated voltage of the ballast		V	12 2/	12
Rated wattage		W	35	35
Test voltage		V	13.5	13.5
Lamp voltage	Objective	V	85	85
	Tolerance		± 17	± 8
Lamp wattage	Objective	W	35	35
	Tolerance		± 3	± 0.5
Luminous flux	Objective	lm	2 800	2 800
	Tolerance		± 450	± 150
Coulour coordinates	Objective		x = 0.375	y = 0.375
	Tolerance area 3/		x ≥ 0.345 y ≤ 0.150 + 0.640 x x ≤ 0.405 y ≥ 0.050 + 0.750 x	
Hot-restrike switch-off time		s	10	10

1/ The part of the bulb within the angles $\alpha 1$ and $\alpha 2$ shall be the light-emitting part. This part shall be as homogenous in form as possible and shall be optically distortion free. This applies to the whole bulb circumference within the angles $\alpha 1$ and $\alpha 2$ except for the black stripes.

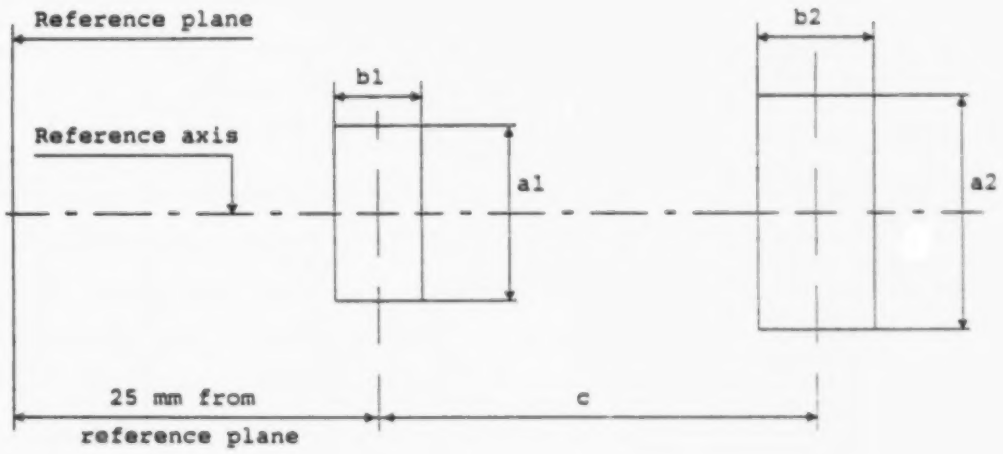
2/ Application voltages of ballasts may differ from 12 V.

3/ See annex 4.

Category D2R Sheet D2R/4

Position of the electrodes

This test is used to determine whether the electrodes are correctly positioned relative to the reference axis and the reference plane.



Measuring direction A and B as defined on sheet D2R/1

Dimension in mm	Production light sources	Standard light sources
a1	d + 0.5	d + 0.2
a2	d + 0.7	d + 0.35
b1	0.4	0.15
b2	0.8	0.3
c	4.2	4.2

d=diameter of the electrode < 0.3

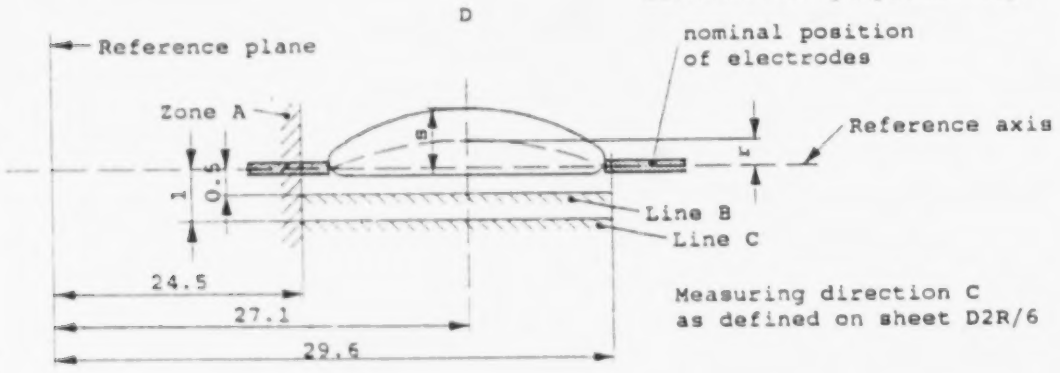
The top of the electrode nearest to the reference plane shall be positioned in the area defined by a1 and b1. The top of the electrode furthest from the reference plane shall be positioned in the area defined by a2 and b2.

Category D2R Sheet D2R/5

Position and form of the arc

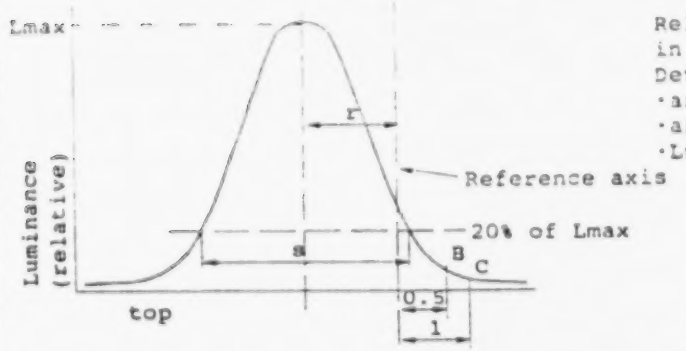
This test is used to determine the form and sharpness of the arc and its position relative to the reference axis and plane by measuring its bending and diffusion in the central cross section D and by measuring stray light intensities in zone A and at lines B and C.

The form of the arc is for illustration purposes only.



When measuring the relative luminance distribution in the central cross section D as indicated in the drawing above, the maximum value Lmax has the distance r from the reference axis. The points of 20% of Lmax have the distance s, as shown in the drawing below.

Dimension in mm	Production light sources	Standard light sources
r	0.50 ± 0.25	0.50 ± 0.20
s	1.10 ± 0.25	1.10 ± 0.25



Relative luminance distribution in the central cross section D.
Determination of:
- arc bending r
- arc diffusion s
- Luminance Lmax

When measuring the luminances from measuring direction B as defined on sheet D2R/6 with a set-up as outlined in Annex 5, however with a circular field of 0.2M mm diameter, the relative luminance expressed as a percentage of Lmax (at cross section D) shall be:

Zone A	≤ 4.5 %

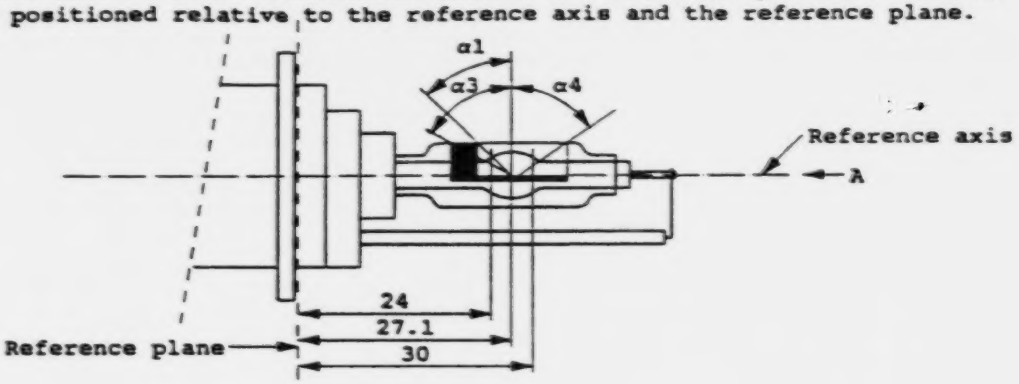
Line B	≤ 15 %

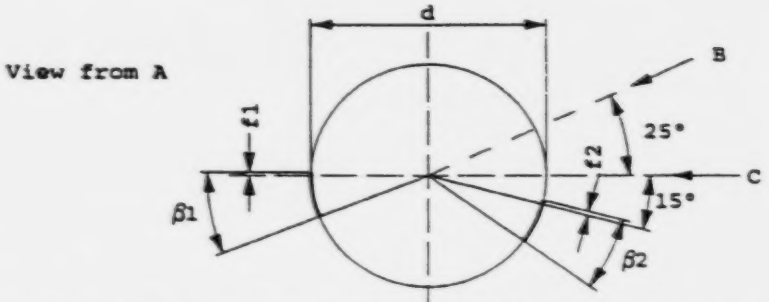
Line C	≤ 5.0 %

The area of zone A is defined by the black coating, the outer bulb and a plane at 24.5 mm from the reference plane

Position of the black stripes

This test is used to determine whether the black stripes are correctly positioned relative to the reference axis and the reference plane.





When measuring the luminance distribution of the arc in the central cross section as defined on sheet D2R/5, after having turned the light source so that the black stripe is covering the arc, the measured luminance shall be ≤ 0.5 % of Lmax.
In the area defined by α1 and α3 the black coating may be replaced by any other means which prevents light transmission through the specified area.

Dimensions	Production light sources	Standard light sources
α1	45° ± 5°	
α3	70° min	
α4	65° min	
β1/24, β1/30, β2/24, β2/30	25° ± 5°	
f1/24, f2/24 1/	0.15 ± 0.25	0.15 ± 0.2
f1/30 1/	f1/24 mv ± 0.15 2/	f1/24 mv ± 0.1
f2/30 1/	f2/24 mv ± 0.15 2/	f1/24 mv ± 0.1
f1/24 mv - f2/24 mv	± 0.3 max	± 0.2 max
d	9 ± 1	

1/ "f1/.." means dimension f1 to be measured at the distance from the reference plane indicated in mm after the stroke.

2/ "../24 mv" means the value measured at a distance of 24 mm from the reference plane.

Annex 2

COMMUNICATION
(Maximum format : 210 x 297 mm)

issued by: Name of administration
.....
.....
.....

concerning: ·APPROVAL GRANTED 2/
APPROVAL EXTENDED
APPROVAL REFUSED
APPROVAL WITHDRAWN
PRODUCTION DEFINITELY DISCONTINUED

of a type of gas-discharge light source pursuant to Regulation No. 99

Approval No.... Extension No....

1. Gas-discharge light source - category . . . . . .
- rated wattage . . . . . .

2. Trade name or mark . . . . . .

3. Manufacturer's name and address . . . . . .

4. If applicable, name and address of manufacturer's representative
. . . . . .

5. Brand and type number of the ballast . . . . . .

6. Submitted for approval on . . . . . .

7. Technical service responsible for conducting approval tests
. . . . . .

8. Date of report issued by that service . . . . . .

9. Number of report issued by that service . . . . . .

10. Approval granted/extended/refused/withdrawn 2/ . . . . . .

1/ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulation).

2/ Strike out what does not apply.

11. Place . . . . . .

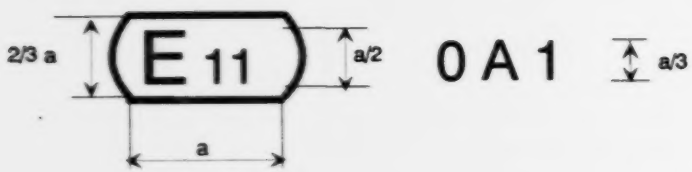
12. Date . . . . . .

13. Signature . . . . . .

14. The attached drawing No.... shows the entire light source.

Annex 3

EXAMPLE OF ARRANGEMENT OF THE APPROVAL MARK
(see paragraph 2.4.3.)



a = 2.5 mm min.

The above approval mark affixed to a gas-discharge light source indicates that the light source has been approved in the United Kingdom (E11) under approval code 0A1. The first character of the approval code indicates that the approval was granted in accordance with the requirements of Regulation No. 99 in its original form.

Annex 4

METHOD OF MEASUREMENT OF ELECTRICAL AND PHOTOMETRIC CHARACTERISTICS

1. General

For starting, run-up and hot-restrike tests and for the measurement of electrical and photometric characteristics, the gas-discharge light source shall be operated in free air with an ambient temperature of 25 ± 5°C.

2. Ballast

All tests and measurements shall be carried out with the ballast submitted in accordance with paragraph 2.2.2.4. of this Regulation. The power supply used for the starting and run-up tests shall be sufficient to secure the quick rise of the high current pulse.

3. Burning position

The burning position shall be horizontal within ± 10° with the lead wire down. Ageing and testing positions shall be identical. If the lamp is accidentally operated in the wrong direction, it shall be re-aged before measurements begin. During ageing and measurements no electrically conducting objects shall be allowed within a cylinder having a diameter of 32 mm and a length of 60 mm concentric with the reference axis and symmetrical to the arc. Moreover stray magnetic fields shall be avoided.

4. Ageing

With the exception of the starting test, all tests shall be carried out with light sources which have been aged for a minimum of 15 cycles having the following switching cycle:
45 minutes on, 15 seconds off, 5 minutes on, 10 minutes off.

5. Supply voltage

All tests shall be carried out at test voltage as indicated on the relevant data sheet.

6. Starting test

The starting test shall be applied to light sources which have not been aged and have not been used for a period of at least 24 hours prior to the test.

7. Run-up test

The run-up test shall be applied to light sources which have not been used for a period of at least 1 hour prior to the test.

8. Hot restrike test

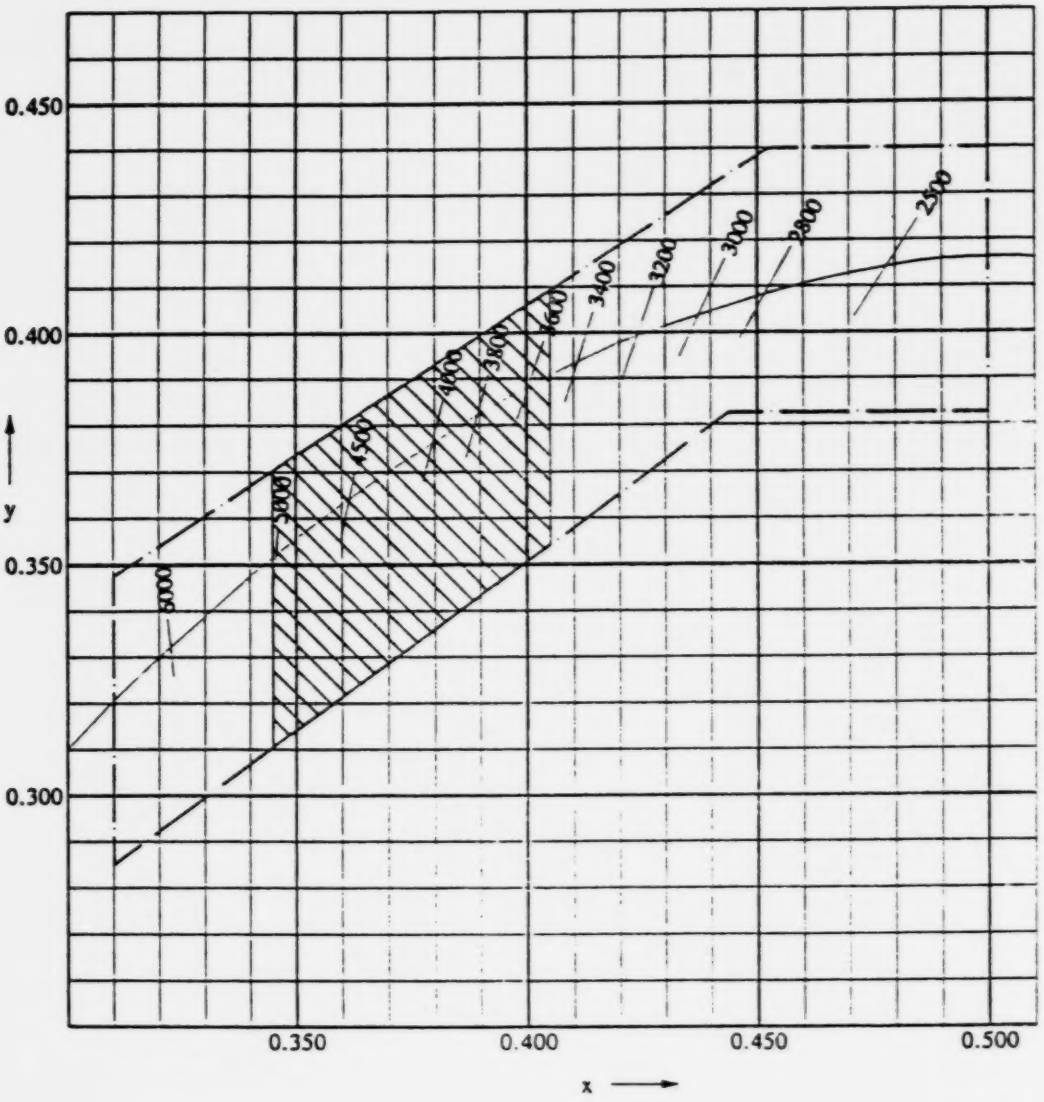
The light source shall be started and be operated with the ballast at test voltage for a period of 15 minutes. The supply voltage to the ballast shall then be switched off for a switch-off period as indicated on the relevant data sheet, and be switched on again.

9. Electrical and photometric test

Before any measurement, the light source shall be stabilized for a period of 15 minutes.

10. Colour

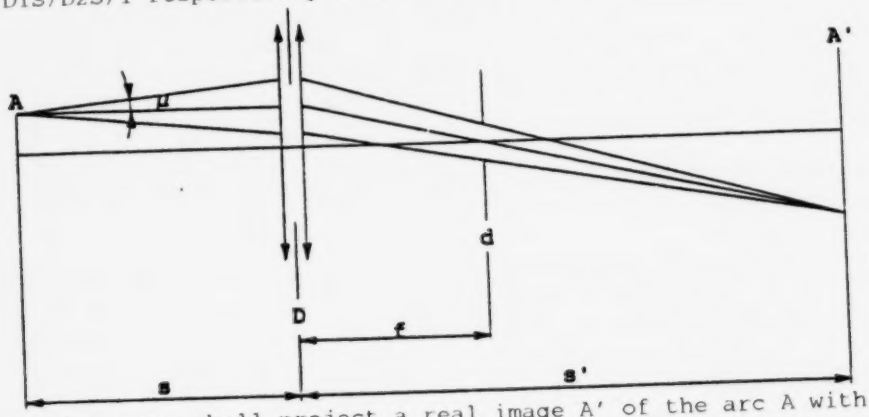
The colour of the light source shall be measured in an integrating sphere using a measuring system which shows the CIE chromaticity co-ordinates of the received light with a resolution of ± 0.002. The following figure shows the colour tolerance area for colour white and the restricted tolerance area for the gas-discharge light sources D1S, D2S AND D2R.


0.450
0.400
y
0.350
0.300
0.350
0.400
0.450
0.500
x
2500
2800
3000
3200
3400
3600
3800
4000
4500
5000
6000

Annex 5

OPTICAL SETUP FOR THE MEASUREMENT OF THE POSITION AND FORM OF THE ARC AND OF THE POSITION OF THE ELECTRODES 1/

The gas-discharge light source shall be positioned as shown in figure 1 on sheet D1S/D2S/1 respectively sheet D2R/1.



An optical system shall project a real image A' of the arc A with a magnification of preferably M = s'/s = 20 on a screen. The optical system shall be aplanatic and achromatic. In the focus-length f of the optical system a diaphragm d shall cause a projection of the arc with nearly parallel observation directions. To get the angle of the half divergence not larger than $\mu = 0.5°$, the diameter of the focus-diaphragm with respect to the focus-length of the optical system shall be not more than $d = 2f \tan(\mu)$.

The active diameter of the optical system shall be not more than:
$D = (1 + 1/M)d + c + (b1 + b2)/2$. (c, b1 and b2 are given on sheet D1S/D2S/4 respectively sheet D2R/4).

A scale on the screen shall enable measurement of the position of the electrodes. The calibration of the arrangement advantageously can be done by using a separate projector with a parallel beam in connection with a gauge whose shadow is projected to the screen. The gauge shall show the reference axis and the plane parallel to the reference plane and at distance "e" mm from it. (e = 27.1 for D1S, D2S and D2R).

In the plane of the screen a receiver has to be mounted movable in a vertical direction on a line corresponding to the plane at "e" from the reference plane of the gas-discharge light source.

The receiver shall have the relative spectral sensitivity of the human eye. The size of the receiver shall be not more than 0.2 M mm in the horizontal direction and not more than 0.025 M mm in the vertical direction. (M = the magnification.) The range of the measurable movement shall be such that the required measures of the arc bending r and arc diffusion s can be measured.

1/ This method is an example of a measurement method: any method with equivalent measurement accuracy may be used.

Annex 6

MINIMUM REQUIREMENTS FOR QUALITY CONTROL PROCEDURES BY THE MANUFACTURER

1. GENERAL

The conformity requirements shall be considered satisfied from a photometric (including UV-radiation), geometrical, visual and electrical standpoint if the specified tolerances for production gas-discharge light sources in the relevant data sheet of annex 1 and the relevant data sheet for the caps are met.

2. MINIMUM REQUIREMENTS FOR VERIFICATION OF CONFORMITY BY THE MANUFACTURER

For each type of gas-discharge light source the manufacturer or the holder of the approval mark shall carry out tests, in accordance with the provisions of this Regulation, at appropriate intervals.

2.1. Nature of tests

Tests of conformity of these specifications shall cover their photometrical, geometrical and optical characteristics.

2.2. Methods used in tests

2.2.1. Tests shall generally be carried out in accordance with the methods set out in this Regulation.

2.2.2. The application of paragraph 2.2.1. requires regular calibration of test apparatus and its correlation with measurements made by a competent authority.

2.3. Nature of sampling

Samples of gas-discharge light sources shall be selected at random from the production of a uniform batch. A uniform batch means a set of gas-discharge light sources of the same type, defined according to the production methods of the manufacturer.

2.4. Inspected and recorded characteristics

The gas-discharge light sources shall be inspected and test results recorded following the grouping of characteristics as listed in annex 7, table 1.

2.5. Criteria governing acceptability

The manufacturer or the holder of the approval is responsible for carrying out a statistical study of the test results in order to meet the specifications laid down for verification of conformity of products in paragraph 4.1. of this Regulation.

Compliance shall be assured if the level of acceptable non-compliance per grouping of characteristics given in table 1 of annex 7 is not exceeded. This means that the number of gas-discharge light sources not complying with the requirement for any grouping of characteristics of any gas-discharge light source type does not exceed the qualifying limits in the relevant tables 2, 3 or 4 of annex 7.

Note: Each individual gas-discharge light source requirement shall be considered as a characteristic.

Annex 7

SAMPLING AND COMPLIANCE LEVELS FOR MANUFACTURER TEST RECORDS

Table 1 - Characteristics

Grouping of characteristics	Grouping */ of test records between gas-discharge light source types	Minimum 12 monthly sample per grouping */	Acceptable level of non-compliance per grouping of characteristics (%)
Marking, legibility and durability	All types with the same external dimensions	315	1
Bulb quality	All types with the same bulb	315	1
External dimensions (excluding cap)	All types of the same category	315	1
Position and dimensions of arc and stripes	All types of the same category	200	6.5
Starting, run-up and hot-restrike	All types of the same category	200	1
Lamp voltage and wattage	All types of the same category	200	1
Luminous flux, colour and UV-radiation	All types of the same category	200	1

*/ The assessment shall in general cover series production gas-discharge light sources from individual factories. A manufacturer may group together records concerning the same type from several factories, provided these operate under the same quality system and quality management.

Qualifying limits for acceptance based on different numbers of test results for each grouping of characteristics are listed in table 2 as maximum number of non-compliances. The limits are based on an acceptable level of 1% of non-compliances, assuming an acceptance probability of at least 0.95.

Table 2

Number of test results of each characteristic	Qualifying limits for acceptance
- 200	5
201 - 260	6
261 - 315	7
316 - 370	8
371 - 435	9
436 - 500	10
501 - 570	11
571 - 645	12
646 - 720	13
721 - 800	14
801 - 860	15
861 - 920	16
921 - 990	17
991 - 1 060	18
1 061 - 1 125	19
1 126 - 1 190	20
1 191 - 1 249	21

Qualifying limits for acceptance based on different number of test results for each grouping of characteristics are listed in table 3 given as maximum number of non-compliances. The limits are based on an acceptable level of 6.5% for non-compliances, assuming an acceptable probability of at least 0.95.

Table 3

Number of lamps in records	Qualifying limit	Number of lamps in records	Qualifying limit	Number of lamps in records	Qualifying limit
- 200	21	609 - 621	52	1 030 - 1 043	83
201 - 213	22	622 - 635	53	1 044 - 1 056	84
214 - 227	23	636 - 648	54	1 057 - 1 070	85
228 - 240	24	649 - 662	55	1 071 - 1 084	86
241 - 254	25	663 - 676	56	1 085 - 1 097	87
255 - 268	26	677 - 689	57	1 098 - 1 111	88
269 - 281	27	690 - 703	58	1 112 - 1 124	89
282 - 295	28	704 - 716	59	1 125 - 1 138	90
296 - 308	29	717 - 730	60	1 139 - 1 152	91
309 - 322	30	731 - 744	61	1 153 - 1 165	92
323 - 336	31	745 - 757	62	1 166 - 1 179	93
337 - 349	32	758 - 771	63	1 180 - 1 192	94
350 - 363	33	772 - 784	64	1 193 - 1 206	95
364 - 376	34	785 - 798	65	1 207 - 1 220	96
377 - 390	35	799 - 812	66	1 221 - 1 233	97
391 - 404	36	813 - 825	67	1 234 - 1 249	98
405 - 417	37	826 - 839	68		
418 - 431	38	840 - 852	69		
432 - 444	39	853 - 866	70		
445 - 458	40	867 - 880	71		
459 - 472	41	881 - 893	72		
473 - 485	42	894 - 907	73		
486 - 499	43	908 - 920	74		
500 - 512	44	921 - 934	75		
513 - 526	45	935 - 948	76		
527 - 540	46	949 - 961	77		
541 - 553	47	962 - 975	78		
554 - 567	48	976 - 988	79		
568 - 580	49	989 - 1 002	80		
581 - 594	50	1 003 - 1 016	81		
595 - 608	51	1 017 - 1 029	82		

Qualifying limits for acceptance based on different numbers of test results for each grouping of characteristics are listed in table 4 given as a percentage of the results, assuming an acceptance probability of at least 0.95.

Table 4

Number of test results of each characteristic	Qualifying limits shown as a percentage of results. Acceptable level of 1% of non-compliances.	Qualifying limits shown as a percentage of results. Acceptable level of 6.5% of non-compliances.
1 250	1.68	7.91
2 000	1.52	7.61
4 000	1.37	7.29
6 000	1.30	7.15
8 000	1.26	7.06
10 000	1.23	7.00
20 000	1.16	6.85
40 000	1.12	6.75
80 000	1.09	6.68
100 000	1.08	6.65
1 000 000	1.02	6.55

Annex 8

MINIMUM REQUIREMENTS FOR SAMPLING BY AN INSPECTOR

1. The conformity requirements shall be considered satisfied from a photometric, geometrical, visual and electrical standpoint if the specified tolerances for production gas-discharge light sources in the relevant data sheet of annex 1 and the relevant data sheet for the caps are met.

2. The conformity of mass-produced gas-discharge light sources shall not be contested if the results are in agreement with paragraph 5 of this annex.

3. Conformity shall be contested and the manufacturer requested to make the production meet the requirements if the results are not in agreement with paragraph 5 of this annex.

4. If paragraph 3 of this annex is applied, a further sample of 250 gas-discharge light sources, selected at random from a recent production run, shall be taken within two months.

5. Compliance approved or disapproved shall be decided according to the values in table 1. For each grouping of characteristics gas-discharge light sources shall be either accepted or rejected according to the values in table 1 */.

Table 1

Sample	1% **/		6.5% **/	
	Accept	Reject	Accept	Reject
First sample size: 125	2	5	11	16
If the number of non-conforming units is greater than 2 (11) and less than 5 (16) take a second sample size of 125 and assess the 250	6	7	26	27

*/ The proposed scheme is designed to assess the compliance of gas-discharge light sources to an acceptance level of non-compliance of 1% and 6.5% respectively and is based on the Double Sampling Plan for Normal Inspection in IEC Publication 410: Sampling Plans and Procedures for Inspection by Attributes.

**/ The gas-discharge light sources shall be inspected and test results recorded following the grouping of characteristics as listed in annex 7, table 1.